



Integrating Distinct Transportation Data into a Single Geodatabase Framework

Pend Oreille County, Washington

Ian Von Essen & Shawna Ernst





Agenda

Project Background

Existing Data

Geodatabase Framework

Geodatabase Modifications

Methods for Integration

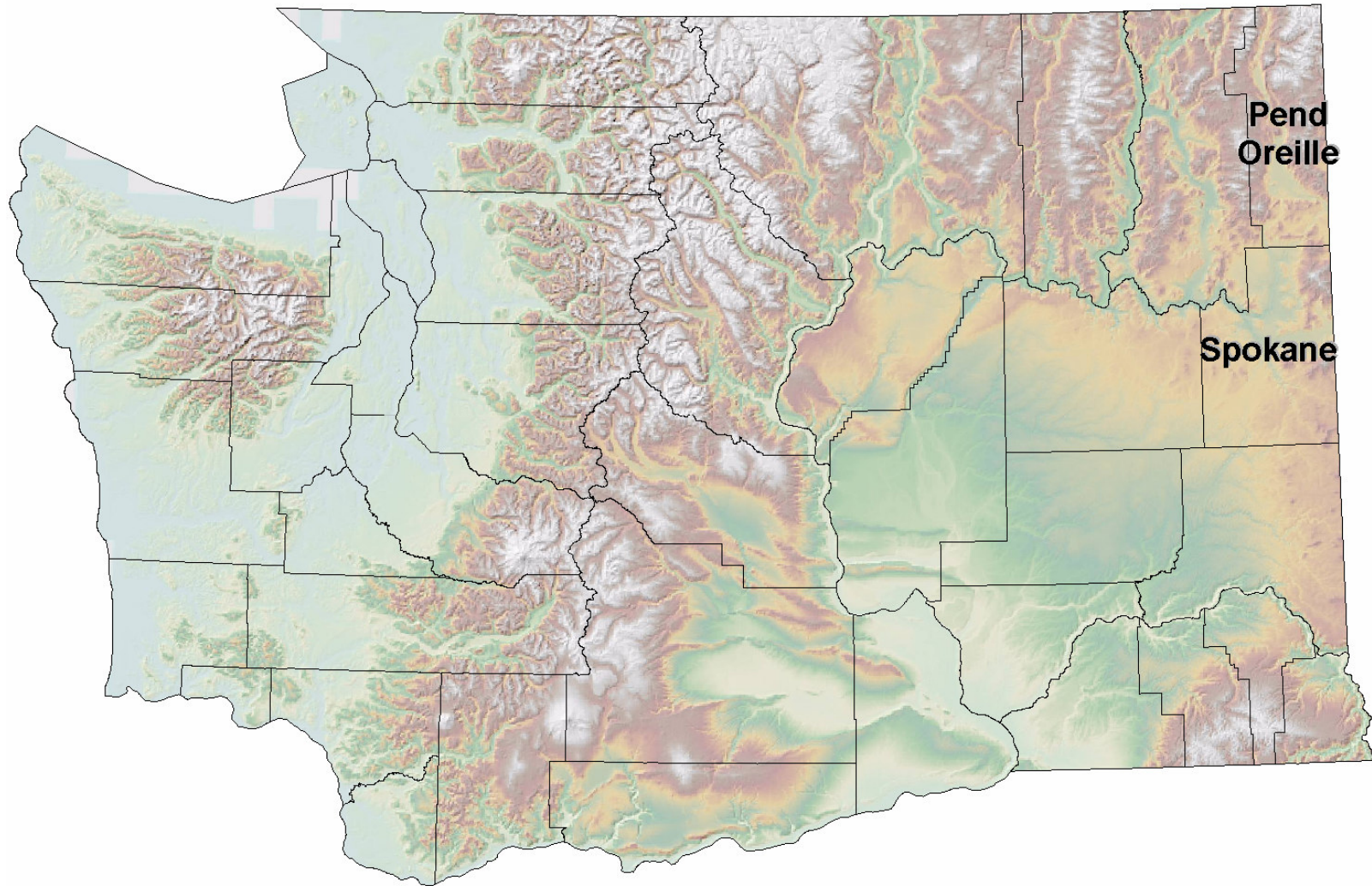
Update Management

Next Steps

Conclusions



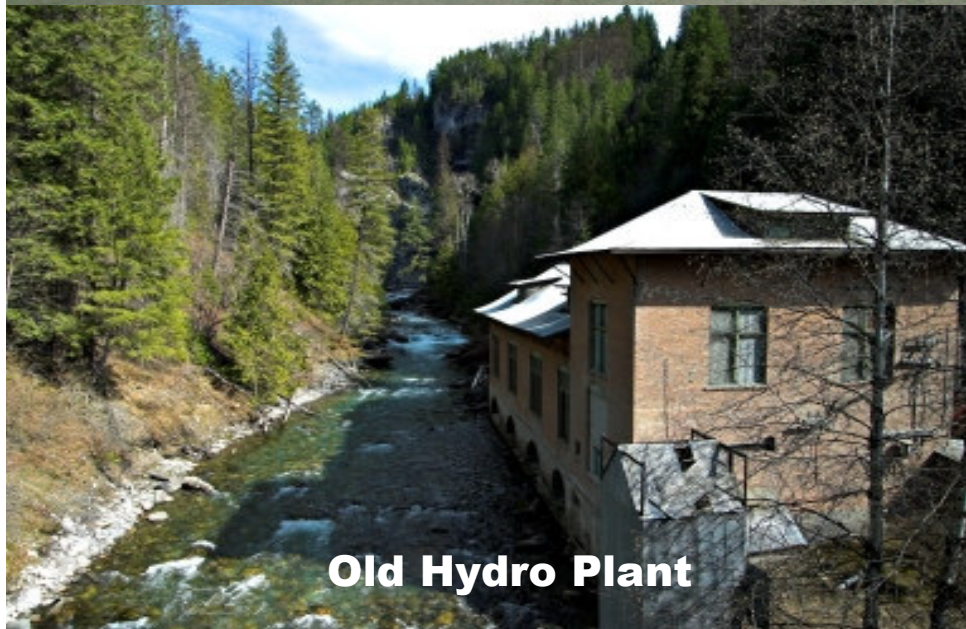
Context



Pend Oreille County, Washington



Newport, Washington



Old Hydro Plant



Pend Oreille River

Pend Oreille County, Washington

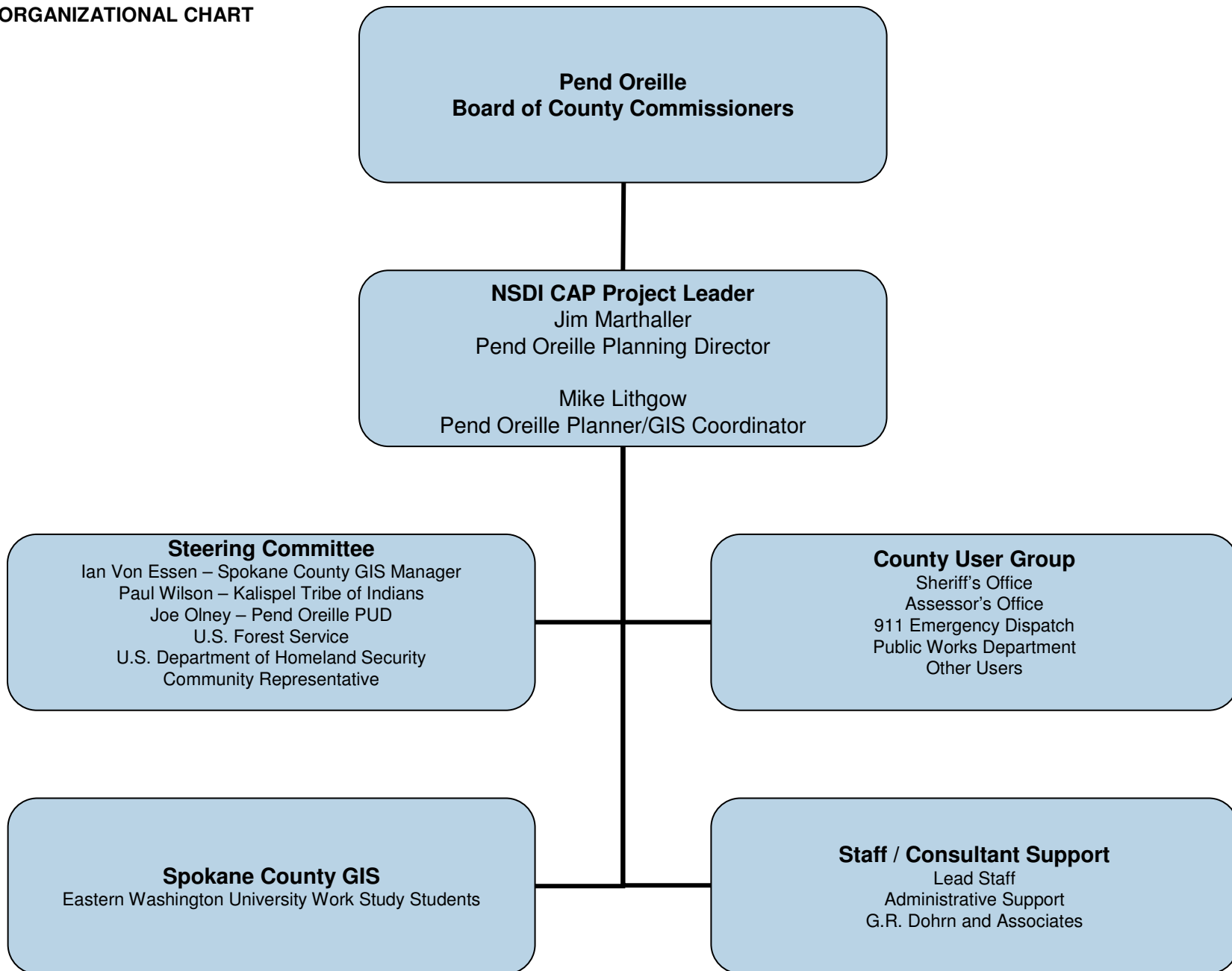




Road Project Timeline

- | | |
|-----------------------|--|
| January 2006 | -Pend Oreille County Submitted USGS CAP Grant Proposal |
| March 2006 | -Pend Oreille County Awarded CAP Grant |
| June 2006 | -GIS User Group Survey |
| September 2006 | -Acquired Washington State DNR Orthophotography (2004 flight)
-Adopted a modified WA-Trans geodatabase model for Pend Oreille County roads
-Began conflation and spatial correction of Pend Oreille County roads data |
| September 2007 | -Acquired Washington State USDA NAIP Orthophotography (2006 flight) |
| October 2007 | -All roads spatially corrected to orthophotography and integrated into a single geodatabase framework |

ORGANIZATIONAL CHART





Road Project Management

Spokane County Staff:

Ian Von Essen - Project Manager

Shawna Ernst - Project Development/Documentation

Ann Bingham - Data Development (GIS Intern)

Pend Oreille County Staff:

Mike Lithgow - Project Liaison

Dorothy Rennich-Kress - Sheriff/911 Mapping Coordinator

Larry Hammel - Engineering/Roads Department



Data Sources

Pend Oreille County Sheriff/911 Roads Data

- Used for Addressing

Pend Oreille County Engineering Roads Data

- Used for County Road No. and Milepost Data

Seattle City Light Roads Data (GPS)

- Used to check spatial accuracy of the project work (not enough coverage to incorporate data as a standalone source)



Data Sources

Washington Department of Natural Resources Orthoimagery (2004)

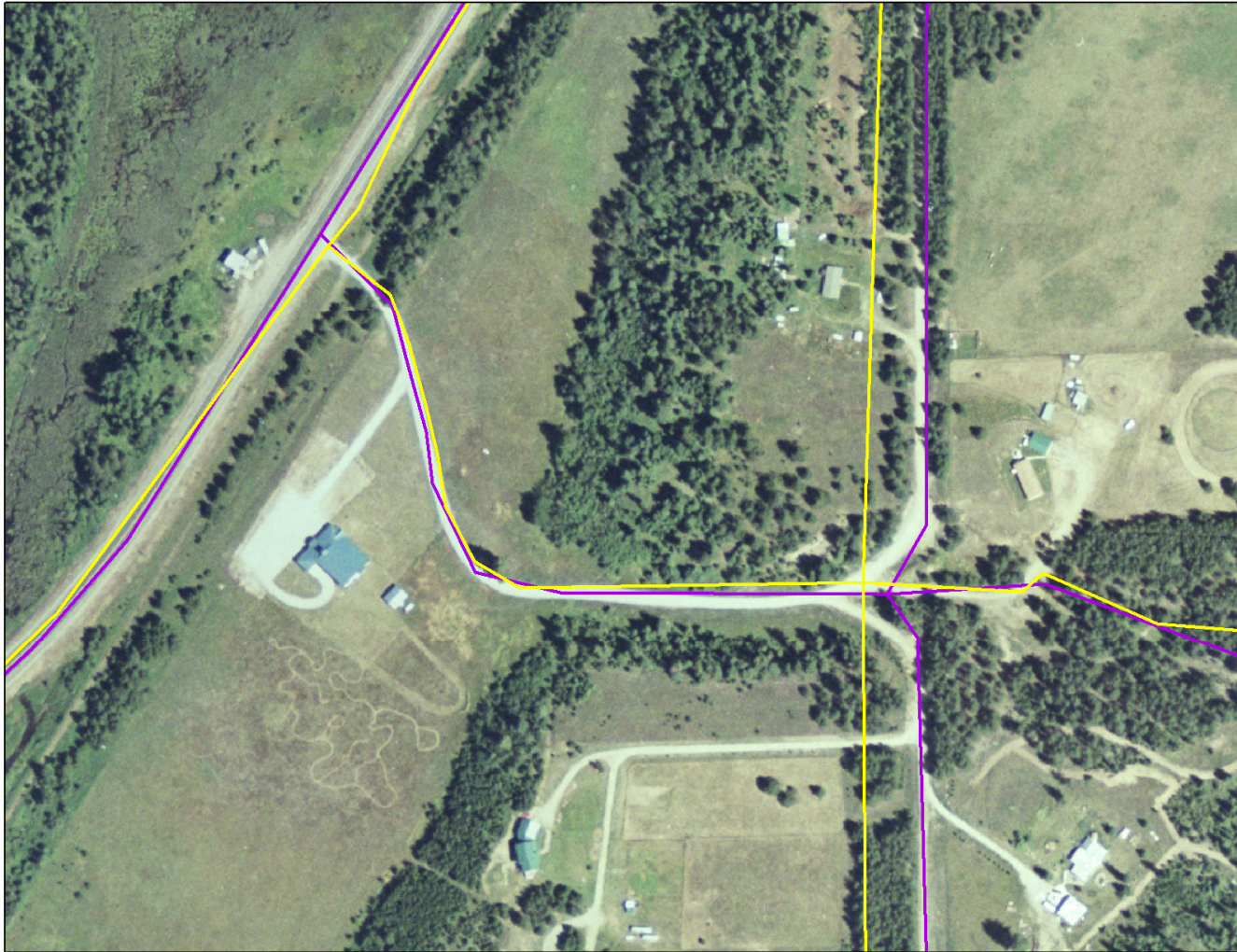
- Used to alter spatial location of roads/intersections in river corridor

USDA NAIP (2006)

- Used to alter spatial location of roads/intersections

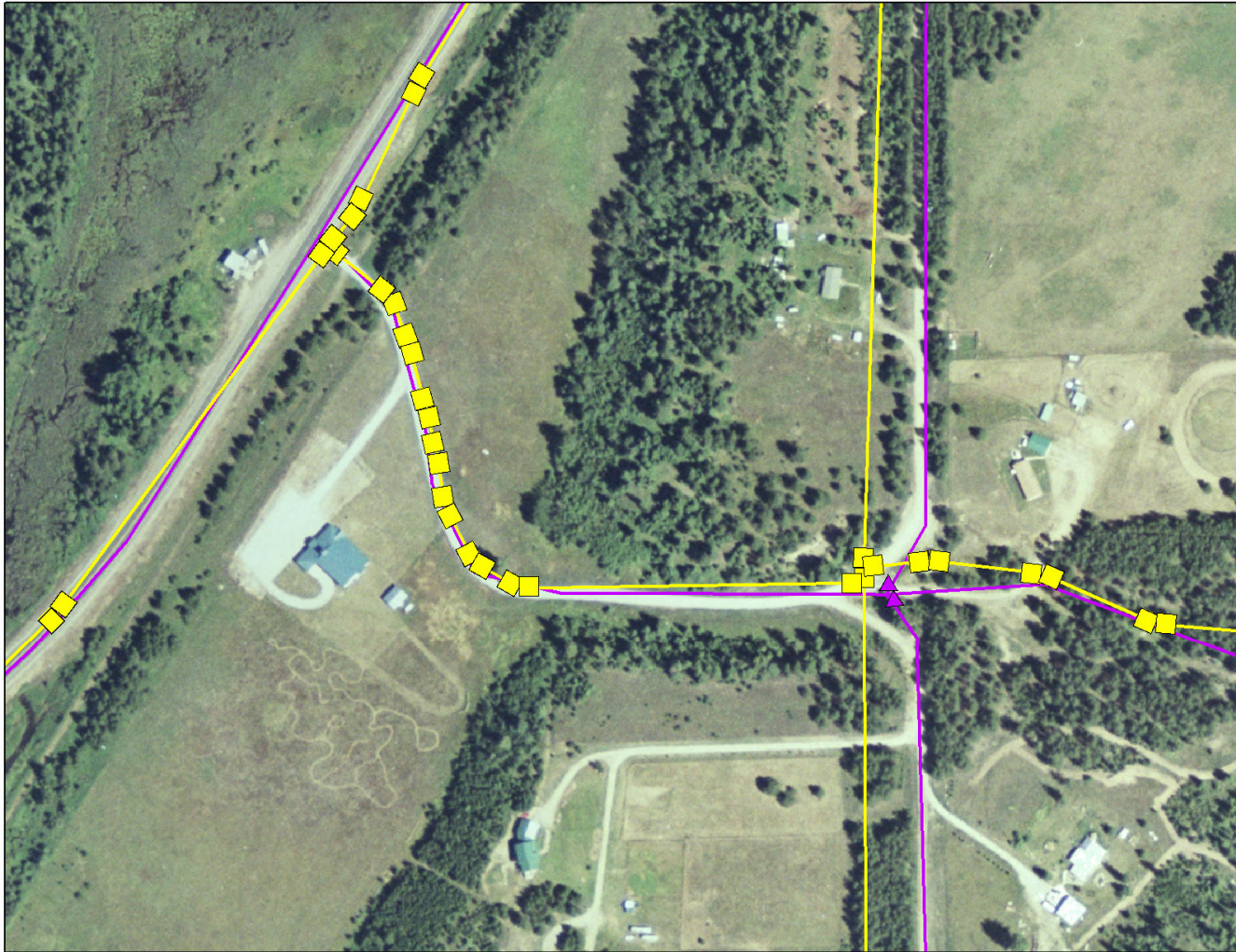


Existing Data





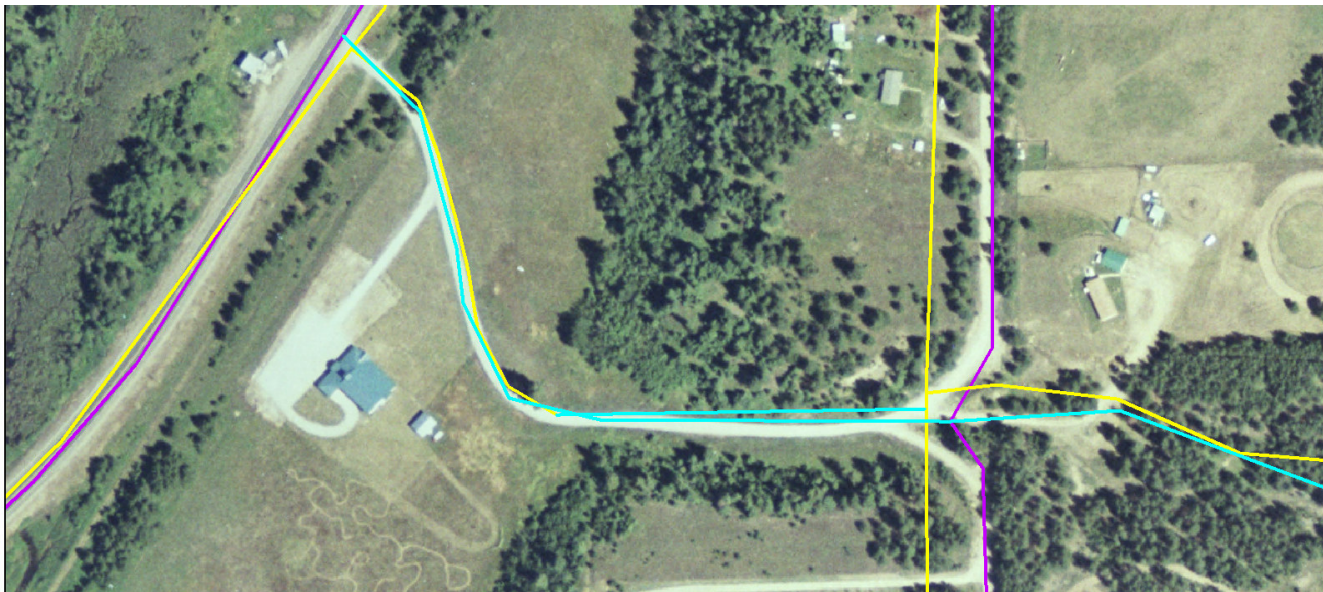
Existing Data





Addressing

	STREET	FROMLEFT	TOLEFT	FROMRIGHT	TORIGHT
911 Data	Sitton	1	1653	2	1654
Roads Dept. Data	Sitton Rd	1327	1361	1328	1360





Addressing

	STREET	FROMLEFT	TOLEFT	FROMRIGHT	TORIGHT
911 Data Roads Dept. Data	Scott	1	160	101	161
	S Scott Av	129	101	130	100





WA Trans Mission Statement

The Washington Statewide Transportation Framework Project (WA-Trans) was organized to create an electronic map and spatial data set of transportation data for use in Geographic Information Systems (GIS) across the state.



**Washington State
Department of Transportation**





Minimum Requirements

Segment Description

Beginning Mile Point

Ending Mile Point

City FIPS Code at Left of Line Segment

City FIPS Code at Right of Line Segment

Street Name



Geodatabase Modifications

Name	Type
WATrans	Personal Geodatabase Feature Dataset
dbo_Event	Personal Geodatabase Table
dbo_EventType	Personal Geodatabase Table
dbo_HorizAccrcyMeasMeth	Personal Geodatabase Table
dbo_LgthAccrcyMeasMeth	Personal Geodatabase Table
dbo_ModeType	Personal Geodatabase Table
dbo_ReferenceDataSet	Personal Geodatabase Table
dbo_ReferencePointAddress	Personal Geodatabase Table
dbo_ReferencePointAgreement	Personal Geodatabase Table
dbo_ReferencePointAirport	Personal Geodatabase Table
dbo_ReferencePointFerry	Personal Geodatabase Table
dbo_ReferencePointModeOrder	Personal Geodatabase Table
dbo_ReferencePointRail	Personal Geodatabase Table
dbo_ReferencePointType	Personal Geodatabase Table
dbo_Segment	Personal Geodatabase Table
dbo_SegmentDescription	Personal Geodatabase Table
dbo_SegmentDescriptionFerry	Personal Geodatabase Table
dbo_SegmentDescriptionRail	Personal Geodatabase Table
dbo_SegmentDescriptionRoad	Personal Geodatabase Table
dbo_Stakeholder	Personal Geodatabase Table
dbo_StakeholderReferencePoint	Personal Geodatabase Table
dbo_Status	Personal Geodatabase Table
dbo_StructureType	Personal Geodatabase Table
dbo_SurfaceType	Personal Geodatabase Table
dbo_TrackClass	Personal Geodatabase Table

Name	Type
PDO_WATrans	Personal Geodatabase Feature Dataset
dbo_HorizAccrcyMeasMeth	Personal Geodatabase Table
dbo_LgthAccrcyMeasMeth	Personal Geodatabase Table
dbo_ReferencePointType	Personal Geodatabase Table
dbo_Segment	Personal Geodatabase Table
dbo_SegmentDescription	Personal Geodatabase Table
dbo_SegmentDescriptionRoad	Personal Geodatabase Table
dbo_Status	Personal Geodatabase Table



Reference Points

The Reference Point Mode Order Indicator field was added to the Reference Point attribute table.

Reference Point Mode Order		Indicates the order of the reference point for a particular mode. A reference point may have different importance, or order to different modes. The same Reference Point can be a different 'order' for different modes. An example is where a bike lane joins a road segment. The point it joins is a first order point for the bike lane as it is the end point for the segment, but for the road, it is a second order point to indicate it is a point of interest, but not a break in the segment.
Reference Point Identifier	CHAR(36)	A GUID from the Reference Point table and used with the Mode Type Identifier is used to identify the Reference Point with a Mode Type
(R) Mode Type Identifier	INTEGER	Foreign Key from the Mode Type table. This is an FK attribute and one of two key attributes, when combined indicates the appropriate mode order for a Reference point.
(R) Reference Point Mode Order Indicator	VARCHAR(5)	Defines the nature of the point of record: 1st order - a point where a segment is broken; e.g. begin/end 2nd order - point not at the break of a segment, but where there is facility information, or public/private road at-grade intersections (e.g. Alley, long driveways). Perhaps we can define additional 'orders' for road/rail at-grade intersections, etc.



Reference Points

Reference Point Type		Defines the nature of a discrete geographic location. Possible values include: <ul style="list-style-type: none">• Jurisdictional Boundaries• Transportation Terminal• Intersection (within a mode)• Multi-Modal Intersection (intersection of one mode with a different mode)
Reference Point Type Identifier	INTEGER	Surrogate Key. Sequential number auto-generated by the database upon insertion of a record. Used to uniquely identify a Reference Point Type record within the database.
(R) Reference Point Type Name	VARCHAR (50)	Code that identifies the type of reference point
(R) Reference Point Type Description	VARCHAR (500)	A description of the type of reference point (as noted above). Note: An Agreement Point is not a reference Point Type, it will generally be an at grade intersection within a mode.



Segment Geometry

Segment Geometry		Stores the Segment Geometry allowing for multiple geometries within WA-Trans.
OBJECTID	INTEGER	Surrogate Key. Identifier applied by GIS Software upon insertion of a record. Used to uniquely identify a Segment Geometry for a Segment record within the database.
(R) SHAPE	INTEGER	Reference to the Geo-Spatial aspects of the data.
(R) Segment Identifier	CHAR(36)	Foreign key into the segment table identifying the segment the geometry is related to.
(R) Segment Geometry Create Date	DATE	Date assigned to the Segment Geometry that indicates the date that the data was created.
(R) Primary Flag	BOOLEAN	Indicates this is the preferred Segment Geometry. Other segment geometries can be included in the database, but will be considered alternatives and not preferred.
(R) Provider Record Identifier	VARCHAR(9)	The unique identifier assigned by the data provider and used in their local systems. This Identifier is stored in WA-Trans for reference to the original data provider attributes schema.
Segment Geometry Update Date	DATE	Date assigned to the Segment Geometry that indicates the date that the data was updated.
Segment Geometry Validate Date	DATE	Date assigned to the Segment Geometry that indicates when that the data was validated (verified).
Segment Geometry Retire Date	DATE	Date assigned to the Segment Geometry that indicates the date that the segment data was retired.
(R) Data Steward Identifier	INTEGER	Foreign Key relating to the entity that is the data steward
(R) Reference Data Set Id	INTEGER	Foreign key into the Reference Data Set table. Refers to original source dataset.
(R) Status Identifier	INTEGER	Foreign key into the Status table. Domain e.g. Operational, Retired, Proposed, Closed



Segment Geometry

Fields Added to Segment Geometry attribute table:

JOIN_Eng – Foreign Key into the Engineering Department's Table

JOIN_911 – Foreign Key into the Sheriff/911 Department's Table

Editor – Editor Name

Editor_Org – Editor's Organization

Errors – Error Subtype Field

Error_Desc – Description of errors



Segment Geometry

Created Common Error Subtypes

No Errors

Multiple Engineering Segments

Multiple 911 Segments

Geometry Issue – Does Not Match Orthophotography

Two 911 Segments Used To Show Two ESN Numbers

Other



Segment Geometry

Added Foreign Keys from the Engineering Department's table into the Segment Description Tables and minimized the number of fields.

Table Properties

General Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
SegId	Text
SegLcld	Text
SegLgth	Double
HorizAccrcyMeasMethId	Long Integer
StatusId	Long Integer
ENG_JOIN	Long Integer

Click any field to see its properties.

Field Properties

Alias	OBJECTID
-------	----------

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply



Segment Geometry

Added Foreign Keys from the Sheriff/911 Department's table into the Segment Road Description Table to provide addressing.

Table Properties

General Fields Indexes Subtypes Relationships

Field Name	Data Type
OBJECTID	Object ID
SegDescrRoadLeftLowAddr	Text
SegDescrRoadLeftHighAddr	Text
SegDescrRoadLeftZipCode	Text
SegDescrRoadRightLowAddr	Text
SegDescrRoadRightHighAddr	Text
SegDescrRoadRightZipCode	Text
SegDescrRoadNamePrfxDirn	Text
SegDescrRoadNamePrfxType	Text
SegDescrRoadName	Text
SegDescrRoadNameSfxType	Text
SegDescrRoadNameSfxDirn	Text
JOIN_911	Long Integer

Click any field to see its properties.

Field Properties

Alias	OBJECTID
-------	----------

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply



Integration Methods

Shapefile Properties [?] [X]

General | XY Coordinate System | Fields | Indexes

Field Name	Data Type
FID	Object ID
Shape	Geometry
STREET	Text
FROMLEFT	Double
TOLEFT	Double
FROMRIGHT	Double
TORIGHT	Double
TYPE	Long Integer
SOURCE	Text
DIRPRE	Text
ESN	Double
FEANAME	Text
CITY	Text

Click any field to see its properties.

Field Properties

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply

Table Properties [?] [X]

General | Fields | Indexes | Subtypes | Relationships

Field Name	Data Type
OBJECTID	Object ID
SegDescrRoadLeftLowAddr	Text
SegDescrRoadLeftHighAddr	Text
SegDescrRoadLeftZipCode	Text
SegDescrRoadRightLowAddr	Text
SegDescrRoadRightHighAddr	Text
SegDescrRoadRightZipCode	Text
SegDescrRoadNamePrfxDirn	Text
SegDescrRoadNamePrfxType	Text
SegDescrRoadName	Text
SegDescrRoadNameSfxType	Text
SegDescrRoadNameSfxDirn	Text
JOIN_911	Long Integer

Click any field to see its properties.

Field Properties

Alias OBJECTID

Import...

To add a new field, type the name into an empty row in the Field Name column, click in the Data Type column to choose the data type, then edit the Field Properties.

OK Cancel Apply



Integration Methods

Added Unique Key Fields

Migrated Key Attributes into WA-Trans Geodatabase

Added Reference Points

Corrected Spatial Geometry of Segments

Coded Unique Keys into Corrected Segments

Verified Topology and Line Directionality



Geodatabase Modifications

Created Geodatabase Topology

Segments Must Not Overlap

Segments Must Not Self-Overlap

Segments Must Be Single Part

Segment End Points Must Be Covered By Reference Points

Reference Points Must Be Covered By Line Segment

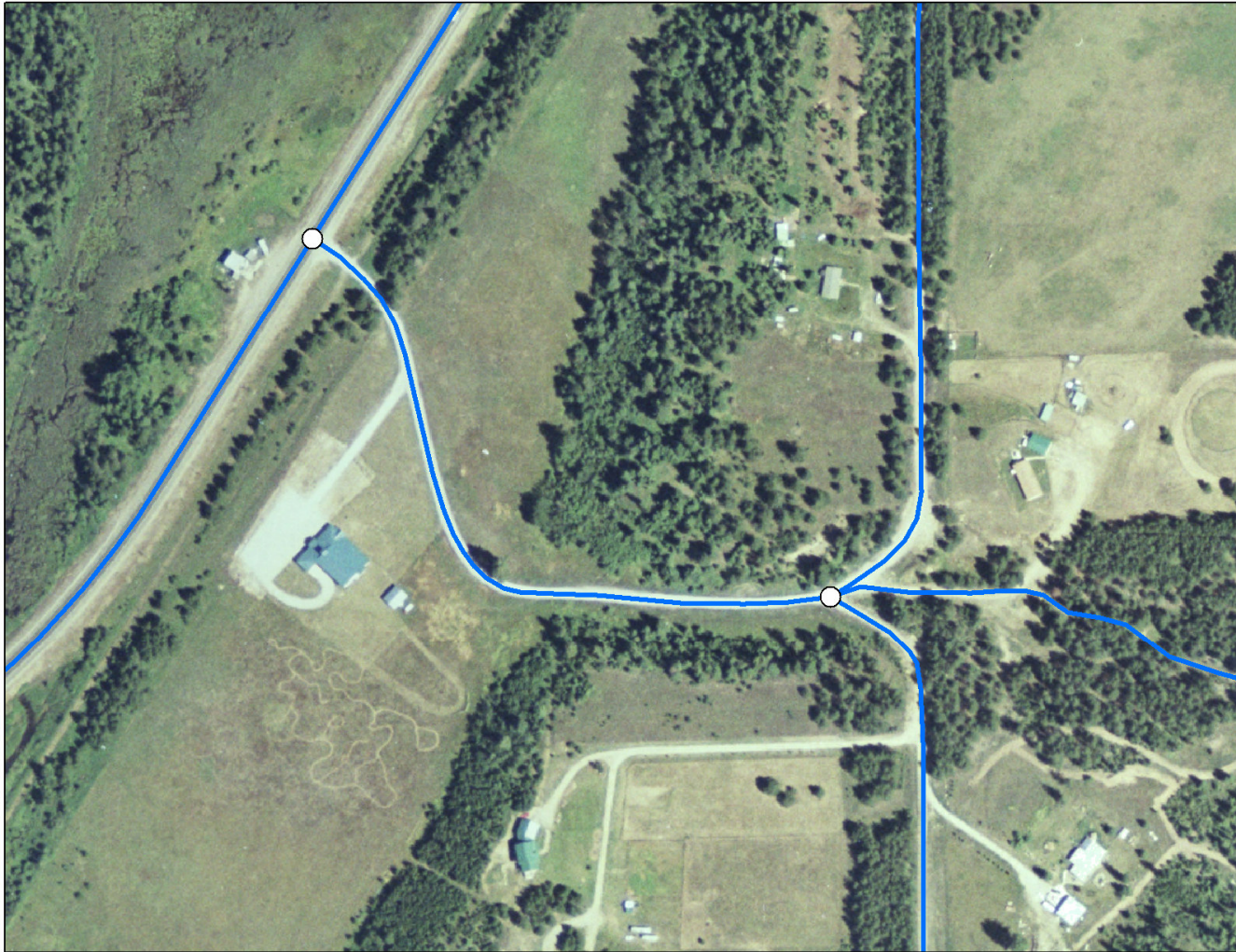


Integration Methods



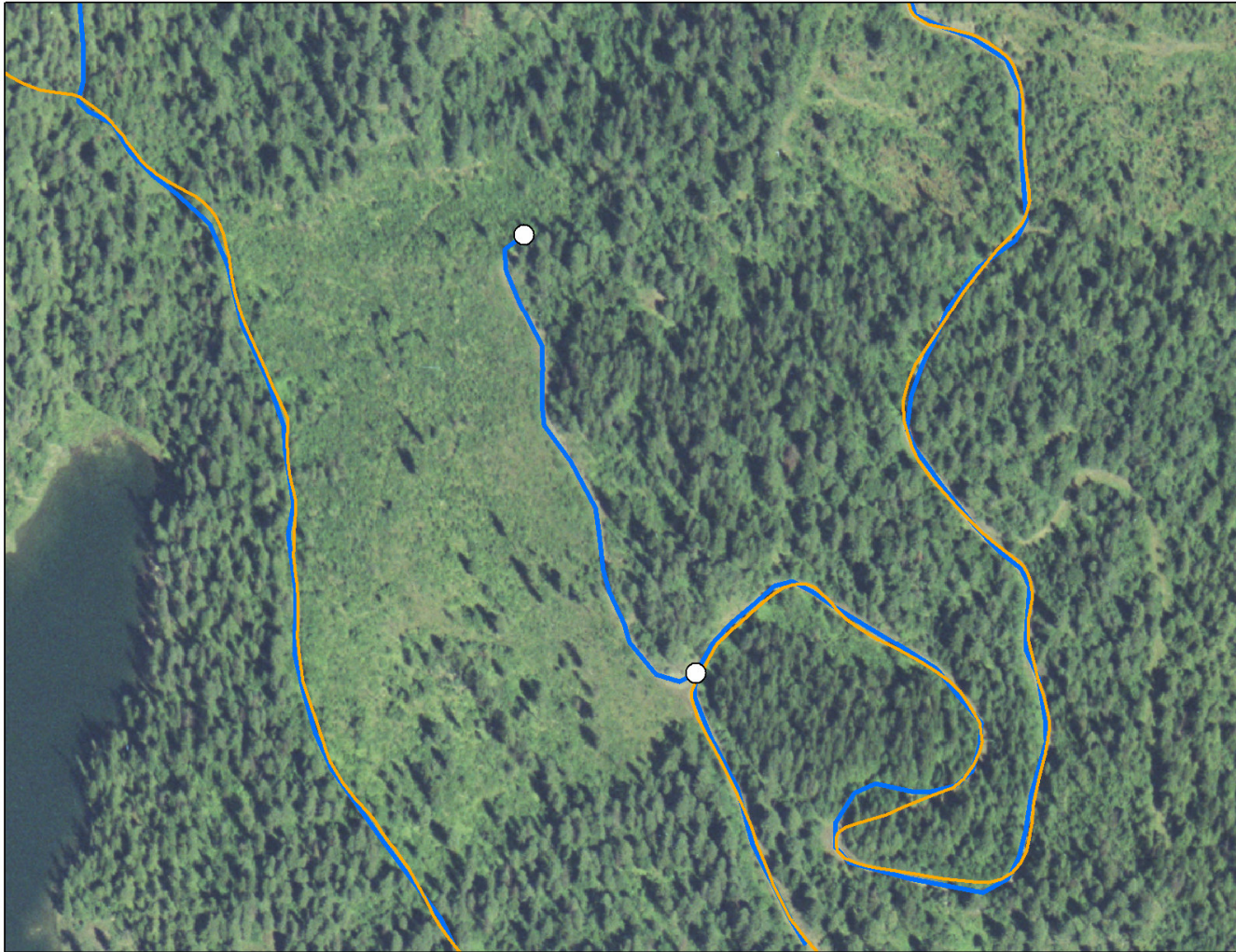


Integration Methods





Comparison With GPS Data





Update Management

Each File is Updated Often

Updates in One File are not Carried Over in the Other

Neither File Contains a Unique Key

Neither File Contains a Date Field

OIDs are Lost in the Map Info to ESRI Conversion



Update Management

Perform an Intersect with Updated File and Geodatabase

- 60 ft. Limit
- FIDs Only
- Export FIDs from the Updated File



Update Management

Select by FID in the Updated File Using the FIDs Found
in the Intersect

Reverse the Selection

Export Selected Data

Append to Geodatabase for Review



Next Steps

Continue to Improve Data and Addressing

Check Data Against Mileposting Data

Integrate with WA-Trans

Integrate with *The National Map*

Monitor Adoption by Pend Oreille County Agencies



Estimated Road Project Costs to Date

	Hours	Project Cost	Rate
GIS Intern	280	\$2,520.00	9
GIS Tech/Specialist	250	\$11,250.00 (@ 45)	45 - 60
Total	530	\$13,770.00	

Conclusions

A transportation geodatabase, like WA-Trans, streamlines the data integration process.

The needs of multiple agencies must be met by the data in order for successful adoption.

A key first step in integrating data from multiple sources is the establishment of unique keys.



Questions?

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